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ABSTRACT

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Constanza C. Hazelwood and
Kathleen J. Roth
with
Literacy in Science
and Social Studies Colleagues

Center for the Learning and Teaching of Elementary Subjects

Institute for Research on Teaching

College of Education

Michigan State University

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The work is designed to unfold in three phases, beginning with literature review and interview studies designed to elicit and synthesize the points of view of various stakeholders (representatives of the underlying academic disciplines, intellectual leaders and organizations concerned with curriculum and instruction in school subjects, classroom teachers, state- and district-level policymakers) concerning ideal curriculum, instruction, and evaluation practices in these five content areas at the elementary level. Phase II involves interview and observation methods designed to describe current practice, and in particular, best practice as observed in the classrooms of teachers believed to be outstanding. Phase II also involves analysis of curricula (both widely used curriculum series and distinctive curricula developed with special emphasis on conceptual understanding and higher order applications), as another approach to gathering information about current practices. In Phase III, models of ideal practice will be developed, based on what has been learned and synthesized from the first two phases, and will be tested through classroom intervention studies.

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Abstract

This paper examines discourse among fifth-grade students in a science classroom. The authors assess students' participation in small-group activities by focusing on their roles during conversation. The issue of gender equity is raised as an important question to be addressed by teachers, students and researchers in the context of science classrooms. Both authors reflect upon their commitment to enact gender equity in their practice and explore questions and strategies to establish norms and rules that benefit every student in a learning community.

Gender and Discourse: The Unfolding "Living Text" of a Science Lesson

Constanza C. Hazelwood and Kathleen J. Roth[1]

With Literacy in Science and Social Studies Project Colleagues:
Corinna Hasbach, Elaine Hoekwater, Carol Ligett
Barbara Lindquist, Kathleen Peasley, and Cheryl Rosaen

> The starting-point of critical elaboration is the consciousness of what one really is, and in "knowing thyself" as a product of the historical process to date which has deposited in you an infinity of traces, without leaving an inventory. (Gramsci, 1971, p. 324)

Our social identities define who we are, and at the same time, they influence who we will be. Each one of us carries "*living texts*"[2] carefully written by ourselves and the multiple authors we encounter as we go on with the process of living. Our historical baggage shapes our own identity as social beings and provides knowledge that we draw on to make sense of our reality. As learners, we own a language of possibilities determined by our social interactions, and we read from our *living texts* to inform our present and future experiences.

The traces that have been left in us by our cultures define how we learn, and also the content of what we learn. Our gender, race, class, ethnicity, age, and academic ability are only a few of many layers of our social identities that mediate our interactions with knowledge. As products of "historical processes," our learning potential is enhanced and constrained by who we are. Thus, as teachers and learners, we need to focus our attention on the "infinity of traces that have been deposited in us," and we must begin an inventory.

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[1]Constanza C. Hazelwood, a research assistant with the Center for Learning and Teaching of Elementary Subjects, is a doctoral candidate in teacher education at Michigan State University. Kathleen J. Roth, a senior researcher with the Center, is an associate professor of teacher education at MSU. The authors are collaborating in the Literacy in Science and Social Studies Project in a local professional development school. Other project participants include Corinna Hasbach, a research assistant with the Center and a doctoral candidate in teacher education at MSU; Elaine Hoekwater, a fifth-grade teacher; Carol Ligett, a third-grade teacher; Barbara Lindquist, a fifth-grade teacher at the school; Kathleen Peasley, a research assistant with the Center and a doctoral student in teacher education at MSU; and Cheryl Rosaen, a senior researcher with the Center and an assistant professor of teacher education at MSU.

[2]The metaphor of living text was borrowed from Corinna Hasbach. The authors conceptualize this term as a function of texts that encompasses the notions of social identity and historicity in the dynamic interactions between students, teachers and knowledge.

A study of students' social identities and their relationships with knowledge is particularly important in the midst of educational reforms that challenge traditional conceptualizations of teaching and learning. Alternative pedagogies that emphasize learners' active participation and engagement in the learning process are leading to teaching practices that promote and encourage communication among learners. Under the assumption that such social contexts are central to the process of learning, teachers and learners need to attend to the sets of norms and rules that characterize a learning community where participants support each other's learning.

In this paper we examine students' discourse about the reading of a science text (Roth, 1988). Our analysis of this classroom event allowed us to recognize multiple kinds of "texts" interacting: *the academic, the social and the living text functions.*[3] In this case the *academic text* is embodied in the textbook explanations that the students were reading. The *academic text* focuses on scientific explanations about how plants get their food. The *social text*, in contrast, consists of information and understandings about participation expectations: How does the teacher intend for students in small groups to interact? How do students negotiate turns and decide what should be the focus of their talk? How do students enact and interpret teachers' intentions regarding participation?

The social text--the intended and enacted sets of norms and rules that are used to organize conversations--depends upon the *living texts* that students and teachers bring to and construct in the classroom. The living text refers to the unfolding of a particular learning experience, drawing attention to the cultural values, beliefs, and attitudes that participants bring into the conversation and the different layers of students' social identities (race, class, gender, age, etc.) and historicities that might hinder or enhance learning.

Through discourse analysis, we gained insights into the ways the academic text gets transformed as it is read and interpreted by different students in a particular social setting. As we

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[3]The three functions of text parallel the propositional, social and expressive functions of language. The propositional function refers to communication of propositional information (referential, cognitive, or ideational function). The social refers to the establishment and maintenance of social relationships. The expressive function refers to the expression of the speaker's identity and attitudes (Cazden, 1988).

recorded and analyzed the unfolding of intended academic and social texts, we uncovered the enactment of dynamic living texts in the interactions between students, teachers and subject matter.

In this paper, we will focus on gender as one layer of social identity that influences the ways students interact and make sense of social and academic texts. We attempt to demonstrate how students' gender influences the content of their discourse and the social organization of their conversations and how students continually frame their gender identities through discourse. We assert that students construct living texts informed by their knowledge about their social identities in addition to their academic and social understandings about learning experiences.[4]

We present two story lines in this paper. One is written by Kathy Roth, the science "teacher" in this classroom, who speaks from her own theoretical and experiential perspectives, tracing her thinking as she interacted with the students and with Constanza Hazelwood, the "researcher."[5] Roth examines how the theoretical frameworks that Hazelwood brought to the analysis influenced and interacted with her own frameworks. The other story represents Constanza Hazelwood's interpretations and descriptions of the classroom event that she selected for analysis. Both stories intertwine and develop as these participants talk about their collaborative effort to understand this event. Where necessary, we identify the speakers in different typeface settings: Roth and Hazelwood.

Context and Participants

Roth and Hazelwood have been members of the Literacy in Science and Social Studies (LISSS) Project since the fall of 1989 at Emerson Elementary.[6] The school is located in a semirural and largely residential community, a few miles from a midsize city in the midwest. The

[4]The literature on science education has emphasized that students come to classrooms with preconceived notions about natural phenomena. This view focuses on students' cognitive development and conceptual understanding. We believe that students also bring to the classroom very clear notions about social hierarchies, social organization and participation which have a tremendous impact on their learning.

[5]We place "teacher" and "researcher" in quotes because our work represents an effort to challenge and redefine these roles. We are trying to blur the boundaries between teacher and researcher and view both of us taking teaching and research roles throughout this study.

[6]The school name and names of students are pseudonyms.

community was once primarily a farmer's community but has grown in recent years to become a suburb of mostly working-class and middle-income families. Many of the students come from low-income families living in nearby trailer parks.

As a professional development school, Emerson provided opportunities for teacher educators, doctoral students, and school-based teachers to engage in teaching and research practices and jointly discuss issues and concerns related to teaching and learning.

In this setting Roth taught science and carried out research activities with a group of fifth-grade students for a period of four months. Most of these students (11 boys and 10 girls) were Caucasian and included students from diverse racial/ethnic backgrounds. There were 3 students of Hispanic descent, 1 of American Indian descent and 1 African-American student. Of the 21 students in this class, only 2 had parents who had completed college. Hazelwood observed these students in science and communication arts during the first four months of the year. For the remaining part of the year she documented and carried out research activities with the same group of students during social studies lessons.

Roth's science curriculum was planned in conjunction with other members of the LISSS group. The year started with an introduction to the nature of scientific inquiry that was integrated with a unit on adaptations of desert plants and animals. This unit led to the topic of photosynthesis, a unit that lasted from the second week in October through December.

The instructional model that informed Roth's teaching was based on a "conceptual change model." Some instructional practices that stem from this model are based on the assumption that students' knowledge grows by contrasting and integrating their own conceptions and experiences with scientific explanations. The process of conceptual change is supported through successful verbal and written communication processes that enable students to "elicit," "challenge," and "contrast" their conceptions about natural phenomena with scientific conceptions. This process requires the establishment of a learning community where students feel comfortable making their ideas public and changing them over time.

Roth has emphasized that some representations of conceptual change instruction do not capture the critical role of the learning community in the process of learning. Hazelwood observed in Roth's teaching an emphasis on the importance of the social text and continual reference to the norms and rules that support learning in a community (i.e., collaboration, valuing all members' contributions, listening to others' ideas, publicly sharing and revising ideas, celebrating the learning process and the new knowledge that is constructed).

Methodology

The data for this study were gathered throughout the school year through daily classroom observations, interviews with focal students, and audio- and videotaping of lessons and interviews. Data collection and analytical frameworks were informed by field work research methodologies as described by Erickson (1986).

For a period of one school year, Hazelwood observed students in the classroom, the playground and the lunchroom. In the classroom she observed and took field notes during science, communication arts and social studies lessons. Research activities included taking, expanding and analyzing field notes, interviewing students, audio-taping and videotaping.

Discourse analysis was based on transcripts of conversations and videotapes. The central piece for this study was a conversation that occurred during a science lesson on photosynthesis. A videotape of this event was played to Roth and to a student participant to capture their retrospective interpretations. Discourse analysis focused on the identification of contextualization cues (Gumperz, 1982) that contribute to define gender boundaries and gender cues that contribute to define discourse. We used the notion of participation structures (Philips, 1972) and their typology (Shultz, Florio, & Erickson, 1982) as analytical frameworks.

Shultz, Florio, and Erickson (1982) developed the typology of participation structures to examine the way in which people accomplish the activity of "talking during dinner." We found it useful to use the this typology as an analytical tool to study student talk in small groups during a conversation about science. For a detailed description of participation structures and their typology

we refer the reader to Shultz, Florio and Erickson (1982) and Erickson (1990). The following summary captures the main ideas that informed our analysis.

There are three distinctive features in the analysis of participation structures: the number of people talking at once, the roles played by the participants, and the number of conversational floors. Erickson (1990) describes the different roles people can play during conversation as a "division of labor in doing the collective work of talking together," and he identifies these roles as *primary and secondary speakers* and *primary and secondary attenders*. The following chart is based on Erickson's characterization of speakers' and attenders' roles:

Speakers	**Attenders**
Primary speaker-- main work of talking, initiating, and maintaining topics, making major substantive points or taking leadership in the production of a narrative by telling details that advance the action, or concluding the current section of discourse.	*Primary attender---* devote full attention to a primary speaker. They may show attention in vocal as well as nonvocal behavior, for example, by uttering brief comments as well as by orienting posturally to the speaker, gazing at the speaker and nodding.
Secondary speaker-- collaborate with the primary speakers by answering a question, echoing the primary speaker's remarks, and commenting on what the primary speaker has said in ways that show interest and approval. By such speaking activity, the secondary speakers assist the primary speaker in holding the floor. Secondary speakers do not compete for the floor with primary speakers; rather they help the primary speaker maintain dominance and a central position in the conversation at that moment.	*Secondary attenders--* may use the same behavioral displays of attention as do primary attenders, but their listening behaviors in relation to the primary speaker may involve smaller expenditures of effort than do the listening behaviors of a primary attender. In addition, the attention of secondary attenders may be split among a number of speakers. Consequently secondary attenders address less of their listening behavior to any one of the speakers than does a primary attender in paying attention to a primary speaker.

Another feature of the typology of participation structures is the notion of "floor." Holding the floor means that someone has access to a turn at speaking, while being listened by other individuals. Together, listeners and speakers contribute to maintain or disrupt conversational floors.

The previous features combined (number of persons talking at the same time, roles, and number of conversational floors) produce an array of four different participation structures

identified as: *Type I, II, IIIA, IIIB and IV* (Schultz, Florio, & Erickson, 1982, p. 103). The presence (+) or absence (-) of each of these features is noted.

Participation Structures	More Than One Person Talking at Once	All Participants Play Equivalent Roles	More than One Conversational Floor
Type I	-	-	-
Type II	-	+	-
Type III-A	+	-	-
Type III-B	+	+	-
Type IV	+	+ or -	+

In the context of schools, the four conversational types are present. Type I and Type II participation structures occur in teacher-centered conversations, for example, when teachers introduce lessons or give instructions to students. On these occasions, there is only one conversational floor with teachers acting as primary speakers. All students participate as primary attenders and, sometimes as secondary attenders. Note that the primary speaker is salient during conversations that have Type I and II participation structures.

Type III-A conversations involve primary and secondary speakers and primary and secondary attenders. Although in these conversations there is overlapping talk, the conversational floor continues to be the same. An example of this type of conversation occurs when students are organized and given different roles to work in small groups. If there is a group leader, this person is expected to perform the role of primary speaker and initiates conversation. As she/he speaks, other people in the group might say something related to what the primary speaker is saying. These comments are not considered interruptions and the primary speaker is not required to acknowledge them.

Type III-B participation structure is a suspension of a previous conversational floor or a sidetrack conversation. Examples of this type of conversation occur more often in small group than in whole group conversations led by a teacher. A student might initiate an "off track"

conversation and this is not considered an interruption. Nonetheless, in these cases, the salience of the primary speaker is at risk if the new speaker does not give up the floor.

In Type IV participation structures there are several conversations going on simultaneously. This type of conversation occurs more often in classrooms where students are allowed to talk among themselves, without the intervention of an authority figure like a teacher. Primary speakers lose salience as multiple conversations get started.

Questions and Theoretical Frameworks

We began this project with a broad idea about the kinds of questions and problems that we wanted to study in Roth's science classroom. To some extent, both of us shared common interests stemming from our past experiences as elementary science teachers and researchers in this field. But we approached the classroom with different assumptions, different roles and different theoretical perspectives.

* * *

Roth's Perspective

As a teacher, I hoped that Hazelwood's analysis would help me think about a particular issue I faced in my science teaching. Over the last several years, I have been trying to create a science classroom in which students are actively involved in constructing meaning. I want students to make sense of science and to develop understandings of science and science concepts that are linked to their personal experiences and ways of seeing the world around them. One change this has stimulated in my teaching is an increased emphasis on small-group work. I am constantly looking for ways to get students--all students--thinking about the issues and ideas we are studying. Small-group discussions and activities seem like a potentially rich way to engage everyone in the sense-making process.

In my first attempts to implement such "teaching for understanding" in a fifth-grade classroom during 1988-89, I found myself moving toward a pattern in which students worked in pairs rather than small groups. And I almost always assigned boys to work with boys and girls to work with girls. This came about because I wanted to do whatever I could to enhance students' opportunities to talk and to get their own ideas out. The students seemed to feel most comfortable talking in same-gender groups. Instead of fighting that and taking on an explicit social text to my curriculum, I decided to keep the focus on understanding the science--the academic text. But at some level, I knew that I was ignoring an important social text in the classroom.

When I began to teach the fifth graders at Emerson Elementary School, I faced a grouping dilemma. Do I continue to allow students to work in same-gender groups so that they can focus more quickly and comfortably on the academic text of the classroom? Or should I purposely group the students in mixed-gender groups to give them opportunities to learn how to communicate across gender boundaries--to help them learn to feel comfortable sharing their ideas and thinking with both boys and girls?

The research frameworks I initially brought to this teaching situation did not explicitly address these questions. I came to the teaching situation having done a lot of study of the literature on constructivist and social constructivist views of learning (Driver & Oldham, 1986; Solomon, 1987; Rogoff & Lave, 1984). In addition, I was familiar with the cooperative learning

literature (Cohen, 1986; Slavin, 1983); I had contributed to the literature in science education that considered the promise of looking at science teaching and learning from a conceptual change perspective. These literatures challenged my thinking about my teaching in many ways--supporting me to examine more closely what the classroom looked like from the students' perspectives (Anderson & Roth, 1990; Carey, 1985; Roth, 1989-90; West & Pines, 1985). But the answers to my questions about grouping were not evident to me from these bodies of research. In fact, I felt like I was "doing it wrong," because the cooperative learning literature definitely advocates mixed-gender grouping. If "they" were so certain that mixed-gender groups were ideal, why was I balking? Why was I even considering (much less enacting) same-gender grouping in my classroom?

During the summer prior to teaching these fifth graders at Emerson, I started reading from literature that focused on gender issues. I was particularly intrigued with the notion of "women's ways of knowing" as described by Gilligan (1982) and others (Belenky, Clinchy, Goldberger, & Tarule, 1986; Weiler, 1988). These authors argued that women in our culture develop different "voices" than men.

And Gilligan's (1982) examples of the differences in moral thinking between two 11-year-olds, Jake and Amy, helped me link this reading to the lives of the 10- and 11-year-olds in my science classroom. Mirroring adults in our society, Jake "solves" a moral dilemma (about whether a husband should steal a drug to

save his wife's life) while Amy considers the human relationships and the contextual particulars:

> Thus in [this] dilemma these two children see two very different moral problems--Jake a conflict between life and property that can be resolved by logical deduction, Amy a fracture of human relationship that must be mended by its own thread. (p. 31)

> Amy's judgments contain the insights central to an ethic of care, just as Jake's judgments reflect the logic of the justice approach. Her incipient awareness of the "method of truth," the central tenet of nonviolent conflict resolution, and her belief in the restorative activity of care, led her to see the actors in the dilemma arrayed not as opponents in a contest of rights but as members of a network of relationships on whose continuation they all depend. (p. 30)

Gilligan eloquently argues that women and men, boys and girls do develop different voices and ways of viewing the world. She challenges the traditional male standard in developmental psychology--that independence, achievement, separation are the standards of maturity. She challenged me to look at myself and the girls in my classroom not as defective but as different in ways that might be helpful for all of us if we--men and women--can understand that we can know ourselves as separate "only insofar as we live in connection with others, and that we experience relationship only insofar as we differentiate other from self." This certainly pushed my thinking about grouping in my classrooms--but it did not provide answers. I could still argue both positions: (a) Boys and girls tend to have developed different sides of emotional and intellectual maturity; if they interact together in productive ways they can become more whole persons,

and (b) girls are less comfortable with the traditionally objective, detached nature of science, and their voices will be drowned out if they are in groups with boys who tend to be more detached from the natural objects of study in science.

My reading on gender issues convinced me that there were ways of thinking about my teaching dilemma that were not addressed in the cooperative learning literature. But these ideas were all new to me. I did not how to use them in looking in my classroom. I eagerly welcomed Constanza's participation in the classroom as a researcher with particular interests in race and gender issues. Once I began teaching and the children were in their self-selected groups (all girls and all boys!), I left the "gender thinking" to Constanza. My teaching and my research questions at the time were focused on the role of writing in science teaching and learning. As I became caught up in my own questions about writing, I lost sight of my gender questions. At that point, it was Constanza who was concentrating on gender issues in this classroom, not me.

• • •

Hazelwood's Perspective

I entered Kathy Roth's classroom influenced by course readings, by my values and beliefs and my personal need to fulfill some course work requirements in the doctoral program. I had my own questions about gender and racial issues which merged nicely with Kathy's questions about grouping students. The combination of my interests and her dilemmas motivated me to pay close attention to the interactions between boys and girls.

The theoretical frameworks that informed my understanding of gender and discourse were drawn from sociolinguistics, feminist and critical educational theory.

From the field of sociolinguistics, the work of Basil Bernstein, has been helpful in providing a framework to study the mechanisms that operate in the transmission of social identity.[7] Bernstein draws our attention to the patterns, choices, and preferences that shape individual and collective acts of speech:

> The identity of the social structure, it is thought, is transmitted to the child essentially through the implications of the linguistic code which the social structure itself generates. . . . The social structure becomes for the developing child its psychological reality by the shaping of his acts of speech. Underlying the general patterns of the child's speech are, it is held, critical sets of choices, preferences for some alternatives rather than for others, which develop and are stabilized through time and which eventually come to play an important role in the regulation of intellectual, social affective orientation. (Bernstein, 1964, p. 57)

The notion that social class is transmitted through socially constructed codes rather than natural genetic codes establishes a reflective relationship between social class and language: "The genes of social class may well be carried less through a genetic code but far more through a communication code that social class itself promotes" (Bernstein, 1973, p. 165).

This notion can serve as a starting point to analyze another layer of social identity which we will refer to as gender identity.[8] Based on Bernstein's theoretical framework we can predict that gender identity generates different speech patterns, which in turn, define gender identity. If gender identity is indeed transferred through language codes, it would follow that members of different gender groups manifest different speech patterns.

Differences in language use between the sexes have been described by Tannen (1990) as a case of cross-cultural communication. This assertion is supported

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[7]In spite of much criticism for supporting the theory of cultural deprivation, Bernstein's work is gaining attention for its contribution to explaining cultural transmission [Karabel & Halsey, 1977 pg. 5]

[8]The constructs of sexual and gender identity are used interchangeably throughout this paper to refer to the sex/gender system defined by Gail Rubin (1975) as "the set of arrangements by which a society transforms biological sexuality into products of human activity" (p. 159). This term suggests that there are complex interactions between biology and culture and that sexuality, as much as gender, is another social construct.

by the observation that boys and girls learn their speech patterns while they grow up in separate groups of peers:

> If women speak and hear a language of connection and intimacy, while men speak and hear a language of status and independence, then communication between men and women can be like cross-cultural communication, prey to a clash of conversational styles. Instead of different dialects, it has been said they speak different genderlects (p. 42).

Research on language use helps us work towards a better understanding of gender as a "property and in part a product of social relationships" (Thorne, in press). This concept of gender as a social construct rests on the assumption that there are similarities and differences between the sexes that become more or less salient in different social contexts. Thus, discourse analysis is a powerful tool to examine the salience of gender within a given context.

I began this study in the role of "researcher" with the idea of uncovering the underlying values and beliefs that shape the notion of gender in this particular social context.

The Unfolding "Living Text" of a Science Lesson

The Intended Social and Academic Texts

During several months the students in Kathy Roth's classroom had been engaged in studying the problem of "how plants get their food." They had formulated hypotheses about this question, they had discussed their ideas with the whole class, and they had conversations in their small groups to elicit, challenge and contrast their ideas. Students had carried out several experiments with their group partners to compare plant growth in the dark and light; with and without water; with and without an embryo. Some students were so engaged in setting up experiments that they met during recess time with Roth to discuss how to set up their own experiments at home.

In December, Roth and her students were discussing the question, Where do plants get their food? The discussion focused on students' results for an experiment where they had planted grass seeds in the dark and in light. Students had written about their results in their textbooks, and they were having an oral discussion based on their writing. The tone and the content of students' and the teacher's comments struck me as cooperative and respectful. Students who engaged in this discussion verbally responded to questions or challenged other students' ideas in ways that seemed constructive. For example, someone contributed the idea that "water doesn't give plants energy." This concept was challenged by Nan who inquired, "Where is your evidence? . . . Do we have it up there?" Nan was referring to the classroom community's learning chart where students kept a large posted record of their hypotheses and emerging findings and evidences to answer the question of where plants get their food.

The whole group seemed to share the notion that knowledge can change over time. Their learning chart, displayed in front of the classroom, attested to the growth of ideas and the process of revision that was taking place in this community. As students added hypotheses and evidence, the chart overflowed and extended to cover the classroom walls and doors. The schedule also was frequently violated when students engaged in discussions that continued through recess time. Not even the physical boundaries of walls would contain the overflow of ideas.

This atmosphere of cooperation, participation and engagement was sometimes altered by different circumstances. On this day, for example, there was an underground movement that seemed distracting, although not overt enough to interrupt the general flow of the conversations. "Hidden" messages coming and going between students sitting next to each other were noticed by Hazelwood and another documenter. Laticia and Roberto were poking each other and playing with a piece of paper. Yolanda also played with her pen and poked Brian, who was sitting next to her. As these students interacted, their messages were not necessarily aggressive, there rather seemed to be a flirtatious tone to them. A major event in this classroom may explain these behaviors. On this day, students were seated in new groups. For the first time this year, students were now all seated in mixed-gender groups that had been assigned by the teacher/researchers. This lesson was also unusual in that it was one of the first times that students were asked to read text together in small groups.

Roth introduced the reading activity that she intended students to carry out during this lesson. She selected a passage from the book *Food for Plants* (Roth, 1988; see Table 1) to be the focus of the reading. This was the first time in this unit on photosynthesis that the students had read about scientists' ideas on how plants get their food--about photosynthesis. The activity was introduced by modeling the following sequence of phases to the whole class: First, she asked a student to read the first paragraph from the text and summarize it. Then she opened a round of questions and answers where she took the role of asking questions and students took the role of answering. The reading sequence she modeled had new roles for the reader. In addition to reading, the student in the role of reading had the duty of summarizing and asking the other members of the group if they had any questions or if anything was confusing.

• • •

The choice of this instructional strategy was not an easy one for me. The students had spent several weeks exploring their own ideas about how plants get their food; they had conducted several

Table 1

Passage From *Food For Plants*

Is Sunlight Food for Plants?

The grass plant experiment shows that plants need light to live and grow. They will die if they do not have light. Does this mean that light is food for plants?

To find out if light is food for plants, you need to know more about plants than we can observe in this experiment. A good explanation of why the plants in the light live and why the plants in the dark die must tell us more than what happened. It must tell us more than "plants need light." We want to know why the plants need light.

Scientists have developed good explanations for these observations. They have done many complicated experiments, and they have done lots of thinking about what is going on inside the plants. What happens to light when it goes into the leaves of plants? Scientists have found that the sun is not eaten or digested by the plant. It is not food for plants.

But sunlight does have something to do with food for plants. Scientists have found that plants are able to do something amazing with the energy that comes from the sun. No humans or animals are able to do what plants can do. Neither worms, fish, birds, monkeys, nor people can do what plants can do with the sun's energy.

Plants can use the light from the sun to make their own food in their leaves. They do not have to go out and catch or buy their food like people do. Read the next section to find out how plants make food inside their leaves.

Source: Roth, K. (1988). Food for plants II: Student text. Unpublished manuscript, Institute for Research on Teaching, Michigan State University, East Lansing. (p. 18)

kinds of inquiries to accumulate evidence to support the different hypotheses that had been proposed. On this day, however, I wanted students to think about the explanation that scientists share--photosynthesis. I was worried about how to present this new information. I did not want the students to feel like I had tricked them--that we had been "genuinely" engaged in problem solving while I had "the answer" up my sleeve all along. Instead, I wanted them to consider the scientists' explanation and its feasibility in relationship to their personal ideas: Does it seem possible given the data we have collected? Does it make sense to us? What are the gaps, the unconvincing parts of this explanation? Does "photosynthesis" help us resolve some of the questions we entered in our Question Notebook as we tried to solve this problem? How certain can we be that this explanation is correct?

I wanted students to question the text's explanation, to connect it to their thinking and experimentation. I did not want them to just hear it and accept it. The instructional strategy I chose for this lesson was designed to engage students in ways that might support them in questioning the text and in linking their personal texts with this official text. In planning this strategy, I never thought about the fact that the students would be in mixed-gender groups for the first time. It never occurred to me that such a reconfiguration of the groups might influence my planning strategy. As usual, I thought about "students" when I planned; I did not think about "boys" and "girls" and the interactions between them. In fact, I would have considered it

sexist behavior on my part to distinguish between how I might teach science for girls and how I would teach it for boys.

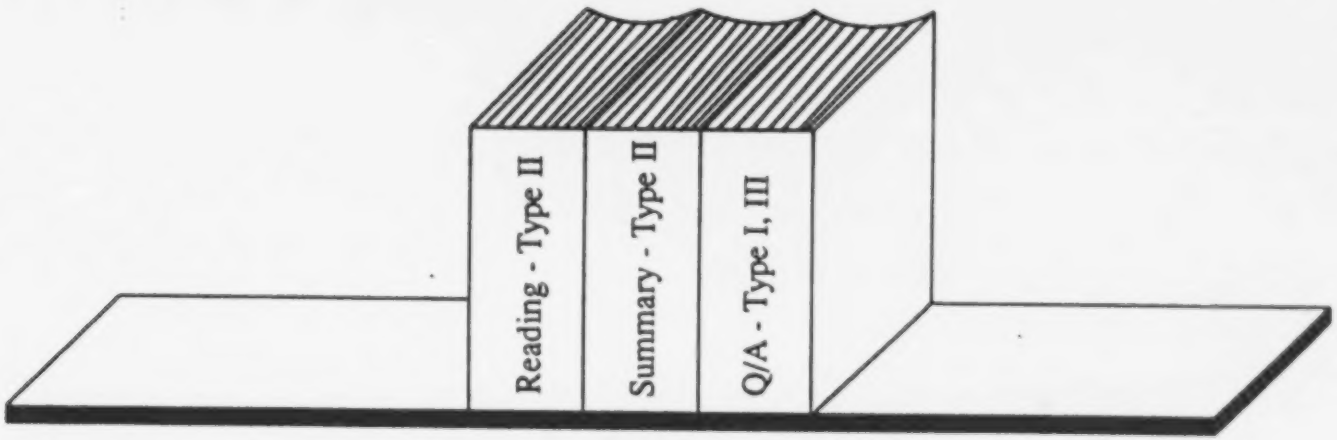
* * *

Roth reviewed some social norms (social text) to remind students about the appropriate behaviors expected from them when they were responding to each other in their small groups. She reasserted her expectation that students should follow the same norms and rules that had been established in their "old" groups. Roth's instructions marked the phases that characterized the reading sequence for each student in the small groups. She introduced an intended sequence with three different phases: reading, summary, questions and answers. These phases had expected participation structures, some of which were explicit and others were implicit.

From Roth's perspective, the reading and summary phases were expected to have a Type II participation structure--where there is one primary speaker and all the people in the audience participate as primary attenders. During these phases, one student was expected to take a turn in talking as a primary speaker and the rest of the group was expected to attend as primary listeners to the primary speaker (see Figure 1).

The Q/A (questions-and-answers) phase had a more complex configuration of roles, since students in the role of attenders were expected to respond to the summary by becoming speakers. This interaction required some assumptions regarding the level of participation of the audience and their respective roles. For example, students had to negotiate their turns to ask questions and make assumptions regarding who was in charge of responding. Hazelwood observed that students tended to assign the role of responding questions to the reader. This seemed to be an implicit expectation on the part of the students. Even though the intended participation structure for Q/A phase was not explicit, it appeared that students and the teacher assumed that there could not be more than one conversational floor, excluding the Type IV structure. It also appeared that primary and secondary attenders were allowed. Thus, the intended participation structure for Q/A seemed to be either Type I or III.

Sequence of Phases



Intended Sequence

Figure 1. Intended sequence.

Q/A - Questions and Answers

Table 2

Analysis of Participation Structure

PRIMARY SPEAKER PARTICIPATION		
Participation Structure Type	Justin	Michelle
I & II	6	2
III	5	1
IV	4	5
Total	15	8

Table 3

Quantitative Analysis of Participation Structure

DISTRIBUTION OF SPEAKER PARTICIPATION					
	Total # of Utterances	PS[a]		SS/PA/SA[b]	
Justin	21	15	71%	6	29%
Michelle	19	8	42%	11	58%
Total	40	23		17	

[a]PS = Primary Speaker
[b]SS = Secondary Speaker
PA = Primary Attender
SA = Secondary Attender

As the intended sequence was enacted, students brought into their interpretations of the social and academic texts their own preconceived ideas about their social identities and the distribution of rights and duties attached to them. We will now focus on the conversation occurring among a group of four students: Michelle, Annie, Russell and Justin.

Encountering the "Living Text"

When students began interacting in their small groups they enacted the intended reading sequence with some alterations. The enacted sequences of phases: reading, summarizing, and Q/A varied in length and order for the different participants. A comparison between the duration of Justin's and Michelle's reading sequences shows the uneven distribution of time for each participant: While Justin's sequence took 3 min. 24 sec., Michelle's sequence took 1 min. 53 sec.

Another variation seemed apparent. Students' salience differed significantly. An analysis of participation structures brought up the issue that even though the number of utterances for Michelle and Justin was similar, 19 and 21 respectively, their salience was noticeably different (see Table 2). A qualitative analysis of their participation raised the issue that each utterance had different significance and salience. While most of Justin's utterances as a primary speaker were done in Type I & II participation structures, where speakers have greater salience, most of Michelle's utterances as a primary speaker were done in Type IV participation structures, where the speaker's salience is reduced.

Qualitative analysis reveals another interesting contrast. If we qualify the number of utterances by role and then quantify the differences, we can see that 71% of Justin's participation was done in the role of primary speaker (PS), compared to 29% in the role of primary attender (PA) and secondary speaker/attender (SS/SA). By contrast, Michelle participated as a primary speaker 42% of the times she spoke, and she engaged in the conversation as a primary attender and secondary speaker/attender 58% of the time (see Table 3).

Discrepancies between the intended and enacted reading sequences were underlined by the groups' rearrangement of their seats. The two boys, sitting next to each other and the two girls sitting across them seemed to have defined a gender boundary that Roth had explicitly intended to

avoid. When she discussed new seating arrangements with Hazelwood and the classroom teacher (a task that took several hours of discussion), she had mentioned that in the past she noticed how students who sat next to each other tended to engage in conversations that excluded the rest of the group. Thus, to improve communication between boys and girls she wanted boys and girls to sit next to each other and not across from each other. Nevertheless, this group of students had rearranged their seats in a spatial arrangement that appeared to define a physical boundary between girls and boys. The girls were sitting next to each other and the boys were facing them (see Figure 2).

As students began the activity modeled by Roth, they started with a role negotiation phase that was not included in Roth's intended sequence. Other variations within each students' reading sequence such as skipping or repeating phases were also apparent. We will take a closer look at the first two reading sequences: Justin's and Michelle's.

Negotiating Turns

"Let me read first"/"I'll read second"

3.	Justin:	Okay. [Raises his hand]. Let me read first. [Speech is loud and clear].
4.	Annie:	O.K.
5.	Michelle:	[Softly and looking to herself]. I'll read second.
7.	Justin:	[Pointing at different paragraphs on the textbook and looking at different members of the group]. _____read that and that.
8.	Russell:	I want to read _____.
9.	Justin:	[Covering his ears with his hands] _____O.K. then she'll read [pointing at Michelle].
11.	Russell:	_____otherwise you read last.
12.	Justin:	No way.

Conventions

" " - Original text
[ ] - Non-lexical phenomena
____ - Inaudible

During this interaction Justin acquired the right to be the first reader, without direct resistance from Michelle or Annie, even though it was apparent that Michelle wanted to be one of the first readers. While Justin expressed loud and clear his desire to read: "Let me read first" (line

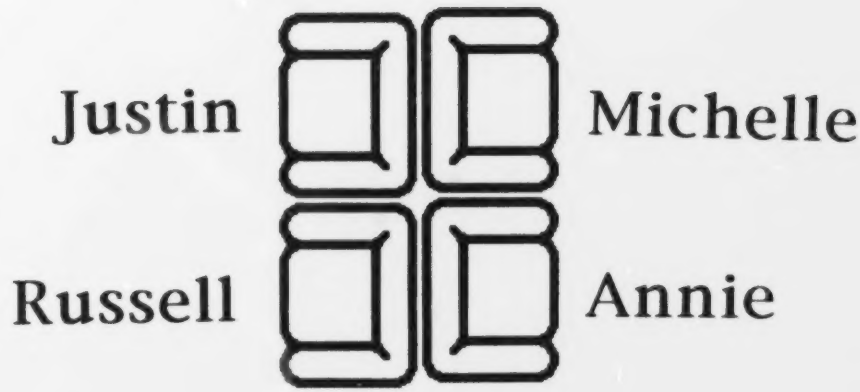


Figure 2. Arrangement of Seats

3), Michelle uttered a soft and indirect statement claiming her right to read second: "I'll read second" (line 5). Later she confirmed her rights by whispering to Annie: "I'm next" (line 17) during Justin's reading turn (p. 22). Russell, on the other hand, challenged Justin's decision: "I want to read_____" (line 8), "____otherwise you read last" (line 11). During this interaction Annie did not seem to be concerned about her turn. My hunch is that she had a sense of cooperation and connection that other students had not developed. Evidence of her sense of collaboration was often expressed by asking questions like: "Is that okay, Michelle?" (line 29).

* * *

While I was observing this group I wondered what was motivating the competition for reading turns. I wondered why reading out loud seemed to be so important to students. In other opportunities I had seen girls competing for the role of reading in front of an audience and challenging each other's competencies to decide who had the right to read. I inferred that students liked the chance to display their skills in front of people. Later, as I reflected on the idea of participation structures and speaker relevance, I realized that the structure of a reading turn (Type II) guarantees prominence and salience to the speaker, like no other participation structure would. In other participation structures, prominence during the interaction can be easily disrupted, especially if someone in the group has more power than others. Thus, in this participation structure the speaker has a granted right of being heard by all the attenders. The Type II participation structure would tend to protect those individuals whose salience is jeopardized by virtue of their gender or other aspects of their social identity such as age, race, or socioeconomic status.

* * *

The reading phase did not have a set time limit, but students seemed to share a common agreement to divide reading turns into paragraphs. The pattern of interrupting reading after each paragraph was followed by students and teachers to give another student a reading turn.

Consequently, students were expected to stop at the end of each paragraph to mark the beginning of the next reading turn.

Justin's Reading Turn

"Let me read the next paragraph"

13.	Justin:	"The grass plant experiment shows that plants need light to live and grow. They will die if they
14.		do not have light. Does this mean that light is food for plants?"
15.	Michelle:	[Turns to Annie and speaks very softly]. _____.
16.	Annie:	[Faces and gets closer to her to Michelle]
17.	Michelle:	I'm next.
18.	Annie:	[Nods].
19.	Justin:	"Find out if light is food for plants."
20.	Michelle:	_____
21.	Justin:	What?
23.	Michelle:	You're_____in a new paragraph.
24.	Justin:	I know, I am.
25.	Russell:	[Pointing at Justin's textbook]. That's another paragraph.
26.	Justin:	[Hitting his book with the palm of his hand]. But that's short. Let me read the next paragraph.
27.		[Roth approaches the group and observes them for a few seconds]
28.	Annie:	Okay, Justin, go to where scientists have developed...Okay?
29.	Annie:	Is that okay Michelle?
30.	Justin:	No. "A good explanation."
32.	Michelle:	_____go to light.

Justin read the first paragraph without interruptions from the attenders. When he got to the end of the first paragraph, Justin continued reading into the second one. Michelle interrupted (line 20) and called students' attention to Justin's violation: "You're in a new paragraph" (line 23). Justin's response uncovered his assumption that he had the right to read longer because his paragraph was short (line 26). He proceeded to negotiate another reading phase.

Justin was the only person in the group who acquired the right to renegotiate his reading turn. While this phase was developing, it seemed like students were concentrating on rights and

their violations rather than focusing on the content of their reading (academic text). This was accentuated by Justin's success in extending his second reading turn beyond the paragraph that the group had agreed on (line 33). His actions seemed to hinder students' opportunities to interact with the academic text.

Girls' Lessons on Compliance

33.	Justin:	Yeah. "Tell us more than what happened.It must tell us more plants need light. We want to know why plants need light."
34.		"Scientists [tone of voice changes] have developed a good explanation for these observations. They have done many complicated experiments and they have done lots of thinking about what is going on inside the plants."
35.	Michelle:	[Moves sideways on her chair and looks away from the group, seemingly disengaged. Attempts to make eye contact with Roth who walks nearby].
36.	Justin:	[Looking straight at Michelle] Your turn.

Justin's violation was not addressed overtly by any member of the group; nonetheless, it seemed like Michelle was not satisfied with Justin's behavior and that she was attempting to call the teacher's attention with her body language (line 35). In the meantime, Justin continued reading. Apparently, Roth's proximity triggered his response: "Your turn" (line 36).

* * *

I was struck by Michelle's response to Justin's second violation of her rights. On his first round, Justin was interrupted by Michelle when he violated the rules. This time, Michelle was silent. She just waited for Justin to give up his reading turn on his own terms. Michelle's body language indicated to me that she seemed to rely on an authority figure to resolve conflict.

* * *

Summary Phase

Ooops . . . "*Sun is food for plants*"

37.	Annie:	We need to summarize it, remember?
38.	Michelle:	Summarize it._____[Laughs].
39.	Justin:	Sun is food for plants...[tone of voice changes] because [pause] I don't know.

40.	Russell:	_____[Emulates Justin's tone as he moves his leg nervously].
41.	Michelle:	We did many experiments.

The end of Justin's turn was marked by his statement: "Your turn." This is evidence of his focus on the social/living texts, rather than the academic text. Justin dismissed the next phase of the intended reading sequence, the summary, until he was reminded by Annie (line 37) about his duties. Justin's summary: "Light is food for plants because. . . . I don't know" represents further evidence of his lack of connection to the academic text (line 39). Furthermore, his assertion misrepresented the content of the academic text (see Table 1) which stated that plants need light to grow, not that light is food for plants.

Justin's summary went unchallenged by the group and misled the discussion. In the context of the whole lesson, it was interesting to follow up the impact of Justin's statement: "Sun is food for plants." A few minutes later, this assertion led to an interaction between Roth and this group of students where they questioned her ability to write clearly, instead of challenging Justin's summary.

Questions and Answers

"He has to say what kinds of questions..."

42.	Annie:	[Raises her hand and faces Justin]. I've got a question. But [pause]
43.		how
44.	Michelle:	[Suddenly turns around to face Annie with a grin on her face] No, he has to say what kinds of
45.		questions
46.	Annie:	Oh yeah.
47.	Justin:	[Moving sideways, playing with his pencil] Anybody have . . . any . . . [changes tone of voice] questions?
48.	Russell:	[Looks at Justin]
49.	Annie:	[Raises her hand]. I do
50.	Justin:	[Turning to the camera as I moved to operate it].
51.	A&M:	[Turn faces to camera].
52.	Annie:	Yeah, but how did you learn about van Helmo . . . [tripping over the word]
53.		van Helmont's experiment.
54.	Michelle:	van Helmont
56.	Russell:	Helmont

57.	Justin:	Because . . . she came in [faces the camera and smiles][9] .
58.	Annie:	Yeah but . . . yeah but why does everybody,
59.		based on Mrs. Mr. . . . .
60.	Justin:	I read that _____[pointing at different pages in the textbook] . . . I know.
61.	Annie:	You did? [facing Justin]
62.	Russell:	You did? [facing Justin]
63.	Annie:	I think the whole class knows.
64.	Michelle:	[Swings sideways in chair and yawns].

When Annie started the questions-and-answers phase, (line 42), she opened up a possible avenue for challenging Justin's summary. Unfortunately the interaction did not continue to focus on the academic text of the lesson but was driven instead by the conflict that appeared from the moment that Justin violated the group's assumptions about the ways they were going to take turns (social text). Michelle interrupted Annie's question by making reference to the norms that Roth had established (social text). She noted that Justin had to follow these norms and that it was his job to ask if anyone had questions (line 44).

Justin proceeded to follow the social/academic texts by asking: "Anybody have . . . any . . . questions?" (line 47), but in his tone of voice he connoted that he was not taking this activity seriously. Justin followed the script and, to a certain extent, Roth's instructions. Nonetheless, throughout his interaction with the group, he was not exemplifying the norms and rules of a learning community. The living text was not in tune with the academic and social texts of the lesson.

Justin continued to drive the attention away from the social and academic texts by looking at the camera (line 50) and making comments that distracted the group (lines 57 and 60). His actions led to a failure in communication and reinforcement of his power to control the direction of the group's conversation and the group's relationship with knowledge. The questions-and-answers phase did not help students expand, clarify or challenge their ideas about the reading and the whole group missed a learning opportunity.

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[9] Hazelwood was standing behind the camera, close to where this group was seated. Justin reminded the group that Hazelwood had participated in a science lesson role playing that she was van Helmont.

Michelle's reading sequence shed some light on the issues involved in understanding discrepancies between the living, social and academic texts.

Michelle's Reading Turn

"Will you shut up so I can read?"

65.	Annie:	Okay. Your turn Michelle.
66.	Justin:	[Places his hands on his ears and faces Michelle]
67.	Michelle:	[Laughing picks up her textbook].
68.	Annie:	[Smiling].Your hand's gray [looking at Justin's hand].
69.	Justin:	Oh!!! Is any[illegible]g confusing?
70.	Annie:	Yeah, you, you're confusing.
71.	Michelle:	Shut up. [Begins reading from textbook] "Scientists" . . .
72.	Annie:	[Looking at Justin]. You're confusing [laughs].
73.	Justin:	[Facing Roth who is approaching the group]. They say I'm confusing.
74.	Michelle:	Will you shut up so I can read? [Smiles].
75.	Michelle:	"Scientists have developed a . . . Scientists have developed an explanation for these observations. They have done many
76.		complicated experiments. They have done lots of thinking about what is going on inside the plant and what happens to light when it goes into the leaves of a plants. Scientists have found that the sun is not eaten or digested by the plant. It is not food for the plant."
77.	J, M &R:	[Bring their fingers to their mouths, look at each other and turn to Michelle]. Shhhh...
78.		Silence [approx. 5 sec].

Michelle's sequence started with a conversational marker: "Okay. Your turn Michelle" (line 65). Justin's nonverbal response apparently communicated that he was not interested in listening. Verbal messages between Annie and Justin (lines 68-72) opened new conversational floors. This was a clear interruption, since it was Michelle's turn to read. Michelle attempted to claim her rights to read several times (lines 67, 71, 74), and finally started reading (line 75).

Michelle's attempts to assert her rights as a primary speaker were another lesson on compliance. First, she overtly stated the idea that she wanted everybody to "Shut up" (line 71) and then she sprinkled the "shut up" message with a tone of politeness: "Will you shut up so I can read?" (line 74). Once more, R[illegible]h's proximity seemed to affect the w[illegible]le group and allow Michelle's turn to begin.

During the reading phase, Michelle's rights as a primary speaker were violated by her group's verbal and nonverbal behaviors. Members of the group were carrying on different conversations and violating their duties as primary listeners. Thus Michelle's reading phase became a Type IV conversational structure and she lost the salience of a primary speaker.

Michelle's Summary

"Can you talk?"

79.	Russell:	Can you talk?
80.	Michelle:	[Turning her body towards Annie]. Okay . . . it's not . . . sun is not food for the plants cause it didn't help the plant grow.
81.	Justin:	[Talks to Russell]_____?

The beginning of Michelle's summary phase was marked by a sarcastic question from Russell: "Can you talk?" (line 79). Michelle's nonverbal response to this question set up a communication boundary between boys and girls. Michelle turned around to face Annie, while the boys sitting next to each other carried on a different conversation. As Michelle communicated an academic message, she intertwined a living text in her summary.

Michelle's summary, like Justin's, was not accurate in communicating the content of the written text. She claimed that sun is not food for plants because it did not help the plant grow (line 80). As Michelle turned away from the boys, she reminded me of differences in communication styles which might originate communication breaks. I wondered if she was aware of her behavior and pursued this question when we watched the video of this lesson together.

Michelle claimed that during this lesson she felt very uncomfortable because she was not used to talking to boys. She asserted: "I'm not used to talking to boys, I'm used to talking to girls. . . . I usually hang around with Heidi and all the girls . . . no boys."

As she spoke about the boys' behaviors that made her uncomfortable, she described the boys' actions in two interesting ways. She claimed that boys acted like they knew everything, and she also described them as people who had control over the group: "They were acting like they were Mr. Smart Man. . . . They were acting like they knew everything, they wouldn't let us do

anything . . . Justin would always speak up for everybody. . . . He thinks that he would be doing everything."

These assertions were very interesting to me. The claim that people who know everything act a certain way called my attention to girls' low expectations about their future careers and their exclusion from science. There might be a connection between the perception that people who know it all, that is students who are good in science, act in ways that seem inappropriate. Are boys' "ways of acting" not only separating girls from boys, but separating girls from knowing? The other assertion, that boys would not "let us do anything," connotes Michelle's compliant behavior and her belief in boys' power to control the group.

Michelle's experience in the mixed-gender group was different in many ways than her experience in a same-gender group where she was before. In her former group, she was viewed by others as a "second leader". This meant that even though the group was more influenced by another one of the members whose role was labeled as "first leader," Michelle's ideas were perceived to carry considerable weight in the group. Michelle talked about differences between both groups in terms of her level of comfort in speaking up. "I was sort of afraid to speak up with this group . . . but then with girls it's not as hard to speak up."

The excerpts from interviews and the vignette above support the assertion that conversational styles between boys and girls are different. This statement was supported by Russell's remarks during the next intended Q/A sequence.

Questions and Answers

"She's got to talk a little louder"

82.	Annie:	Are you confused?
83.	Justin:	[Raises hand].
84.	Annie:	No. She . . . she hasn't asked you yet [facing Justin] _____.
85.	Russell:	I'm confused because I couldn't hear her.
86.		She's got to talk a little louder.
87.	Annie:	You two were talking.

Michelle's voice was absent during the questions-and-answer phase. The social/living texts became the focus of conversation between Russell, Justin, and Annie. Students focused on

the norms and rules to be followed rather than raising questions about the content of the reading. The opening question: "Are you confused?" (line 82) was followed by Justin's nonverbal signal [hand raising], but none of these remarks led to a discussion of the academic text.

Annie claimed that Michelle had to ask the question first: "No. She. . . She hasn't asked you yet_____." (line 84). Russell claimed that he was confused because Michelle did not speak loud enough (line 85). Russell's remark called my attention to girls' voices since I had noticed that girls' comments were often lost in whole-class discussions because they did not talk loudly enough. But this time the tape recorder picked up Michelle's summary quite well, and it seemed that something else had contributed to a breakage in communication. My observation was that Michelle's posture signaled that she was talking to Annie exclusively. This nonverbal message contributed to define the boundary between boys and girls.

As the conversation continued, the boundary line between sexes gained prominence. Annie accused the boys of having a conversation among themselves while Michelle was giving her summary: "You two were talking" (line 87). Throughout this interaction Michelle did not speak. Right after Annie confronted the boys, she promptly re-initiated her summary (line 88).

Summary

"Just shut up and read"

88.	Michelle:	[Higher pitch and slower tempo] I said the sun is not food for the plants because. . .
89.	Russell:	I think the sun is food for plants.
90.	Annie:	[Pointing at her book]. But it says in the paragraph about going inside the plants. What happened?
91.	Michelle:	Just shut up and read.

Michelle initiated a second summary phase that was very short. In this interaction, there seemed to be a glimpse of focus on the academic text when Russell challenged the statement that sun is not food for plants (line 89) and Annie responded by focusing on an interesting point: "What happens inside the plants?" (line 90). Even though these ideas were just starting to be discussed, Michelle promptly ordered Annie to shut up and read, as if she did not want to open the floor to this discussion.

* * *

Once more the living and social texts interfered with the unfolding of an interesting discussion about the content of this lesson. My reading of this interaction is that Michelle was reacting to the previous accusations that Russell had made about her. As to why she responded to Annie in an authoritarian way, I can only speculate that Michelle found a way to control the situation by ordering someone else, in this case Annie, a Native American whose status was considered lower by her classmates [Interview with Annie 12/91]. Michelle's effort to gain control seemed to drive this short phase to an end.

In contrast, I could infer that Michelle was not engaged in studying the academic text carefully and she was just following the script. But this explanation did not fit in with her critical analysis of the text that followed Annie's reading sequence. The events that followed Michelle's reading sequence were relevant to understand the question of whether or not the students were engaged in this learning experience and if they were learning something about light and food for plants.

The "living text" does not end here. As a researcher, I struggled with the issue of defining the boundaries of discourse analysis. To make this analysis manageable, I had to segment the conversation and analyze only two reading sequences. This segmentation of students' interactions seemed far removed from the actual construction of living texts in the classroom; nonetheless, I had to remind myself that I was not attempting to reconstruct the living text of the classroom but just engaging in a form of analysis that might help us understand it.

I will give the reader a glimpse of the events that took place right after Justin and Michelle's reading sequences, since they shed some light on understanding the unfolding living text. I have mentioned earlier that Michelle's engagement in the academic text was highlighted by the conversation that took place later, during Annie's reading sequence.

* * *

After Annie finished her reading sequence Russell started his turn by claiming that he did not want to read. Instead he and Justin started to make fun of Michelle by imitating her way of reading (following the text with index finger) and mumbling some sounds. Their behavior was interrupted by Annie:

Annie:	Justin, I have a question. What did you just read? Please read it over.
Justin:	Ahhh!!!! [Tone connotes impatience]. Plants can use the light from the sun to make their own food in their leaves. They do not have to go out and catch or buy their food like people_____ [Mumbling].
Annie:	What?
Annie and Michelle:	[Chorus]. Read the next section to find out how plants make food inside their leaves.
Michelle:	Summarize your paragraph little boy.
Annie:	Yeah!
Roth:	[Approaches the group].
Justin:	O.K. [Tone of voice changes, background laughter]. Plants can use the light to make their own food in their leaves.
Justin:	[Moving around in his chair] Peewee Herman.
Michelle:	You guys, all these things said different things.
Annie:	Yeah, I'm confused
Chorus:	Yeah!!!
Justin:	Did you write this? It's confusing. [Facing Kathy Roth].

Roth approached the group and the students explained why the text was confusing. Annie and Michelle mentioned that in one paragraph it said that sun is food and the next paragraph said that sun is not food. "Then," Annie added, "You go on to a completely different thing and you didn't say why." Roth looked at the written text and responded:

Roth: O.K. let's go back, let's do a really good reading. Let's go back to page 18 and see why you got confused. In the second paragraph . . . it says "*if* light is food for plants, you need to know more about plants than we can observe in this experiment. A good explanation . . . must tell us more than what happened." It must tell us "*why* the plants need light," so that's not saying that light is food. We need to find out.

Annie: But in this one it says "sun is not food for plants . . . plants are able to do something amazing with the light." Then it says up here "the grass plant experiment showed how plants need the light to grow.". . . That means light is food for plants and that one says light is *not* food for plants.

Roth: I see what you mean [nodding]. O.K. look at this sentence over here. It says, "But sunlight does have something to do with food for plants." What I was trying to say was that the sun itself is not food for the plants, but the sun does have something to do with food for plants.

Annie: Maybe you should explain it more.

Roth: I think I should, and you're really helping me think about how to rewrite it.

This conversation seemed connected to the kinds of norms that were being established in communication arts lessons. In this context, students were learning to take the author's chair and conference with their teachers and classmates about their writing.

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In spite of evidence indicating lack of understanding during the reading sequences, the conversation with Roth spoke to students' ability to read text critically. Both Annie and Michelle pointed at specific segments of the text which they found

confusing and suggested revisions. By engaging in this conversation, students also demonstrated their ability to question the authority figures of the author and teacher.

At first glance, this interaction might be interpreted as a successful and meaningful learning experience for all students in this group. Nonetheless we must not lose sight of the fact that students did not engage successfully in conversations with each other. Furthermore, the source of misunderstanding of the text was related to students' inability to communicate accurate summaries and raise questions that probed understanding.

It was very interesting for me to gain some insights about the way Roth had perceived this event. As an observer in the classroom, I had a vivid image of Justin taking the initiative to call Roth over to their group and Annie driving the conversation. After having the chance to put this conversation in context and taking a closer look at social interactions, I realized that Justin had gained prominence because he acted in a way that drew my attention and not because he had relevant contributions to make about the content of the reading. In contrast, Michelle, who had pointed at conceptual contradictions in the way she understood the text, was lost in the conversation with Roth as much as she had been in the group interactions.

. . .

At the end of this class session, I was excited about one event in particular--the interactions I had had with Justin, Annie, Michelle, and Russell. In my view at the time, they had interacted with the text in exactly the ways I had intended. They did not just accept the text as gospel. Their willingness to challenge me as the writer of the text provided evidence that our learning community was developing into a genuine place where ideas--everybody's ideas--were central, not just the authority of teacher and text. The incident was also exciting to me because it

suggested that students were making some important links between their experiences in writers' workshop and their experiences in science.

They saw texts as being authored, as coming from people, rather than as abstract sources of ultimate knowledge. Clearly, the academic text (how were they making sense of the idea of photosynthesis?) and my own research questions about writing were most salient to me in my interactions with this group. The only "gender" thought that crossed my mind that day was that the new mixed-gender groups seemed to be working well, an observation that confirmed my usual approach of thinking about students as learners, not as girls and boys.

As you look back at the last paragraph, you will see I constantly refer to the students in the group as "they." My initial reaction as a teacher was to generalize about the group. Pushed afterwards by Constanza's questions about my reactions to the event, I was able to remember that not all students were equally involved in my conversation with them. It was Justin who called me over to the group, and he and Annie were the most vocal and excited as we talked about the text. In fact, afterwards I had the impression that Michelle and Russell had not contributed at all to the discussion. I was eager to see the videotape of the lesson to see if my impression was correct.

Constanza later showed me the videotape and asked me to comment. I knew she had seen something in this incident related to gender issues, but I saw nothing about gender as I watched it. She talked to me a bit about what she was seeing, but it still

seemed pretty vague to me. I wondered "so what?" That's an interesting set of observations about the workings of one particular group on one particular day, but what does it say to me as a teacher? What does it say to other teachers?

It was not until I read her full analysis, using the social participation structures tool, that I started seeing gender issues in this interaction. I needed to see the whole story of the evolution of the conversation before I interacted with the group, in order to see the interactions of this group as being in any way problematic. And I needed to see the interactions as problematic before the incident could speak to me as a teacher and push my thinking about my teaching. But once I saw the way that Michelle--who I had in many ways written off as "flaky," silly, and not very thoughtful--actually initiated the ideas ("You guys, all these things said different things") but got no "credit" for them, my eyes were opened to a new way of looking in my classroom.

This analysis helped me see Michelle in a new light, as a very thoughtful reader of text who, despite some unpleasant social negotiations, was genuinely trying to link her reading with the experiences she had had in science class. How many other students were getting "written off" based on such a focus on products and outcomes of group work rather than on the processes during small-group interactions? I had always known that there was more to know about small-group interactions than just the products of their efforts. But I previously had no tools for looking inside these group interactions.

Discussion

The implicit assumption that students can engage in intellectual partnerships regardless of their social identities is an ideal rather than an empirical finding. At Emerson school, gender emerged as a factor that defined the possibilities and modes of interaction among students inside and outside the classroom.

The data analysis that we carried out allowed us to see that social identity influences discourse interactions. This was evident in the spatial arrangement of the group, in students' verbal and nonverbal cues, and in the uneven distribution of rights and duties for each participant. The documentation of concrete details about teaching and learning helped to reveal inequities that can easily go by unnoticed by teachers and researchers. But documentation alone did not do the job of highlighting differences between boys and girls. The analytical tool of participation structures allowed us to qualify students' distribution of roles and refine an otherwise superficial and probably inaccurate assessment of students' participation in conversations.

Through discourse analysis, we disclosed issues of salience and conflict which are relevant to understanding girls' and boys' perceptions of their roles in conversation. This analysis underlines the need for teachers to get involved in helping students learn strategies to deal with conflict. Michelle, for example, needed to develop the language of rights and duties to articulate inequities in her group and label the violation of her rights to reclaim them.

Likewise, students need to know that an apparent lack of engagement in conversation, like Russell's and Justin's movement in their chairs, might be explained as a difference in conversational styles. Nonverbal cues might mislead girls to infer that boys are not engaged in conversation when, in fact, they might be just displaying different communication patterns. On the other hand, boys might interpret girls nonverbal cues (i.e., Michelle's posture towards Annie) as barriers in communication instead of viewing them as different norms of conversational involvement.

This event is reminiscent of Tannen's (1990) remarks about cultural differences between men and women. Tannen studied same gender and cross gender conversational patterns across different ages and observed that

> Differences in physical alignment, or body language, leap out at anyone who looks at segments of the videotapes one after another. At every age, the girls and women sit closer to each other and look at each other directly. At every age, the boys and men sit at angles to each other-in one case, almost parallel- and never look directly into each other's faces. I developed the term anchoring gaze to describe this visual home base. The girls and women anchor their gaze on each other's faces, occasionally glancing away, while the boys and men anchor their gaze elsewhere in the room, occasionally glancing at each other. (p. 246)

In light of these findings, we ask what can teachers do in their classrooms to improve the quality of learning opportunities and establish norms and rules that benefit every individual in a learning community?

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I have been working with these insights for quite a while now. At first, I thought Constanza's research enabled me to see in new ways in my classroom but not to act differently. For example, I have watched videotapes of the group she studied and come across other occasions where very similar discourse patterns unfolded. I know I would not have seen those patterns had it not been for Constanza's study. But as I continue to talk to Constanza about how she is using the insights from the case to inform her teaching practice and ongoing research efforts, I am beginning to see ways that can use what I learned from this case to take action as a teacher.

What actions might I now take as a teacher? First, I will look in new ways at small-group interactions. As I wander the classroom during small-group time, I will probably choose to listen and to stay with one group for a longer period of time

(instead of quickly moving from one group to another multiple times during a work period). And I will certainly be listening to the students as girls and boys, not just as students. Are the girls being heard? I will be thinking of interacting to support the group process--the social text--not just the academic text. Are there ways that I can encourage quiet girls to use the structure of the task to assert their salience in the group? Are there ways that I can support the boys in thinking about the ways they communicate their ideas and how they do or do not contribute to the group's work? Can I support all students in more genuinely listening to each other?

And what about the grouping issue? Next year, how will I group the students? Hazelwood's analysis does not provide "the answer" to this question. But it has made me committed to including mixed-gender groups as well as same-gender groups. How can boys and girls learn to talk "across cultures" if they are always separated? Might gender interactions in a carefully supported environment help boys develop desirable "feminine" traits of caring and connection and girls develop "masculine" traits of assertiveness and logical objectivity? At the moment, I see myself starting the year with student-selected groups, which will most probably be same-gender groups.

Once some of the positive aspects of the learning community are established, and all students seem to be coming more comfortable with sharing their ideas publicly, I will switch to gender-mixed groups. But unlike last year, such a switch will not simply happen without any explicit discussion about the change.

Next year I will talk with the students about the differences in talking together among students of the same gender and across gender boundaries. Perhaps I will engage them in some kind of mini-study of themselves and their interactions in the group, to help us all learn more about how to make these interactions educative--about the social, the lived, and the academic texts. This study has committed me to action and further study in changing the dynamics of the interactions between girls and boys so that girls can find their voices and salience in science classrooms.

* * *

Is it desirable to establish patterns of organization where boys and girls have more interactions across gender boundaries in classrooms? As teachers and researchers we continue to question how boys and girls benefit or suffer when different forms of social organization are promoted in the classroom. Do teachers need to add gender to an already long list of concerns and dilemmas in making decisions about grouping?

The problem of equity needs action and reflection on the part of all the participants involved in social interactions. Teachers, students and researchers together need to become researchers of the social organization of the classroom in order to understand how we enact social texts and interact with academic texts as we draw from and create new living texts.

If we believe that our educational efforts should lead towards a more equitable society, we must take seriously the question of sex segregation in schools and understand that intellectual partnerships between members of the opposite sex do not necessarily occur spontaneously. We need to connect power relationships in and outside our classrooms and realize that by grouping students with members of the opposite sex, we are not guaranteeing them equal learning opportunities.

We need to ask if we are contributing to the establishment of gender boundaries in the classroom and reflect upon the consequences of such actions. By looking at our social identities and historicities teachers, students and researchers can engage in conversations about the social knowledge that we all bring into classrooms and draw our attention to issues of equity and diversity that constitute part of the living text of every lesson.

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